little value, as the birds differ so much in size and coloration, some being black over the nostrils and others quite pale. As to wing-measurements, there seems a little difference, but one of my specimens has a wing quite as large as one marked *B. leucophæa*. All my birds are in worn plumage, which gives them a mottled appearance.

Lamprocorax panayensis.

a. ♀ ad. ; *b*. ♂ juv.

The Philippine Glossy Starling is plentiful. The young bird had fallen from the nest at the foot of a dead tree. It was unable to fly.

Eulabes palawanensis.

a, *b*. ♂ ad. ; *c*, *d*. ♀ ad.

The Palawan Wattled Myna is a common and conspicuous bird. It was noticed in pairs, and generally found where there was dead timber standing.

Corvus pusillus.

a. ♂ ad.

This is a curious little Crow, having a voice like a frog. It was very common, particularly near the Iwahig landing.

XXX.—*The Bird-Caves of the Bermudas and their Former Inhabitants.* By Dr. R. W. Shufeldt, Washington, D C.

(Plate XX.)

Early in the month of August, 1915, Dr. F. A. Lucas, Director of the American Museum of Natural History of New York City, invited my attention to the fact that there was, at that time, an interesting collection of fossilized bones of birds from the Bermuda Islands at that institution, which stood in need of study and description ; he desired to know if I would give them the required attention. This invitation I was glad to accept, as it opened up for me research along a line in which I had never before been engaged, and in due course the material—a most valuable

lot of specimens—was sent to my Washington home for examination; it included a small lot that had been collected a few years previously by Mr. Louis L. Mowbray, who is now attached to the New York Aquarium of New York City.

Hardly had I made a superficial examination of this famous collection, when it was amplified through the courtesy of Mr. Edward McGall, of Orange, New Jersey, who very generously added his private material, of the same character, to that which Dr. Lucas had already sent me; indeed, Mr. McGall was the fortunate one who had collected all these interesting specimens, apart from the few Mr. Mowbray had obtained. Both explorers had secured their finds first-hand in the almost inaccessible and very beautiful Bermudan caves.

As it did not appear to be at all likely that any new additions would be made to what I now had on hand, I gave the series a fairly thorough investigation; and I was satisfied that all the bones—there was a long string of them—belonged to various sea-birds, apparently to such forms as we know as Shearwaters and Petrels. In addition, I found one or two shells, examples of which are still to be found on these islands in great numbers. Finally, I found the fossilized claw of a crab, which, although found elsewhere on the Atlantic seaboard, was not known to have ever occurred in Bermuda. This constitutes a beautiful example of that class of cases where a harmless and inconspicuous animal will, for some unknown reason, become entirely extinct over enormous areas, and still remain in existence in others.

These Bermudan caves are very recent in their formation; they certainly are not, at the very limit, more than five centuries old, and maybe a century or so less. My particular interest centred about the unravelling of the history of the famous bird long known by the name of "Cahow" and by several other names, which are not necessary to enumerate here. At one time the "Cahow" was extremely abundant on these Bermuda Islands, and bred there in

untold millions at the time of the early settlers, some three centuries ago. It was a nocturnal species, possessing discordant notes; and so fearless of man were these birds that they would alight on the head, shoulders, and arms of any person visiting their breeding-grounds. This unusual fearlessness resulted in the final extermination of the species; for the first inhabitants of the islands, and those that followed them in a comparatively short period, utterly destroyed the birds for food, notwithstanding their enormous numbers. All this has now become a matter of history, and one of the most extensive contributors to it is Prof. Addison E. Verrill, of the present faculty of Yale University. There are a great many writers on the subject, and most of them firmly believe that the Cahow was a Shearwater of the genus *Puffinus*; in other words, that it was a bird still to be found on the Atlantic Coast, and known as Audubon's Shearwater (*P. lherminieri*). Others, however, doubted this, and believed the bird to be an extinct Petrel; and there were other opinions in regard to the matter, all of which have been fully set forth in my memoir on the subject, which will presently be published by the American Museum of Natural History. A little further on in this article I shall refer again to these Bermudan birds; but I first desire to give a brief account of the caves themselves, and the difficulty that attended the collecting of the subfossil bones which were sent to me for description.

It is more than likely that a number of these caves still remain to be discovered, while a few, which are known to exist, are so inaccessible that no known explorer has ever ventured to get into them. Even the one in which Mr. McGall found the bird-bones he secured, could only be entered under almost insurmountable difficulty. By means of ropes, and at the imminent risk of his life, he was at last rewarded by being able to tread where no man had ever trod before, and to view scenes that no human eye had previously rested upon. For those who love adventure and yearn to accomplish such feats as this, there is still plenty of opportunity, in some of the islands of Bermuda, to

gratify the craving, and to enjoy the discovery of material entirely unknown to science.

Mr. McGall did some beautiful work, and had some narrow escapes in these caves; he visited no fewer than eight of them in all. In the one in which he found the fossil bird-bones, the floor was formed of decomposed coral, which had thoroughly dried out, and it was due to this fact that the bones had been so well preserved. In many places the coral has crumbled, and in this sort of sand we find the bones in an excellent state of preservation. Overhead, the roof is thickly festooned with dead stalactites of various lengths. One of these, which I have examined, is of a dull clay colour, rough and brittle, and has the appearance of being composed of agglutinated, coarse sand. Most of the caves—this one among the number—are very dry; while in the wet and moist ones no bones were discovered. In the latter, as a rule, both stalactites and stalagmites were growing—that is, they were increasing in size from the mineral or other products in the drippings. Where Mr. McGall found bones, he did what all collectors do not invariably do: he took the trouble to pick up every little bone he could find, however insignificant it appeared, and this very greatly assisted me when I came to study the skeletons.

Mr. Mowbray, who has an equally interesting story to tell, first found bones in the Crystal Cave, some time in 1907. One year later he presented some of these bones to the Smithsonian Institution, with the view of having them identified. He, too, was under the impression that the major portion of the bird-bones found were those of *Puffinus obscurus*: while in Bassett's Cave he collected a perfect skull and beak of Strickland's Shearwater (*P. stricklandi*), the specimen being covered with calcite, brought down by the drippings in this grotto. He also obtained a living specimen of Peale's Petrel (*Æstrelata pealii*), which was, perhaps, the first specimen ever secured by science on this side of the Atlantic. After this bird died it was

preserved for the Boston Museum of Natural History, where it now is.

In one of the three stalactites collected by Mr. Mowbray in Crystal Cave, he discovered three feathers embedded about an eighth of an inch in the calcite, one of which was brown and the other two white. With respect to these, Mr. Mowbray wrote me on the 10th of February, 1916: "The finding of these feathers, agreeing in colour with the description of the early writers that the Cahou was russet and white, and the skull differing from those of the Shearwater, convinced me that the find was a good one and without question the long-looked for Cahou."

When my above-mentioned work on the Cahow appears, there will be found in it a full discussion of these "russet feathers," and of the hazy idea the early writers had of that colour. Then, too, the fossil bird-bones from Bermuda, turned over to me for description, go to prove that the extinct Cahow was a Petrel and *not* a Shearwater at all.

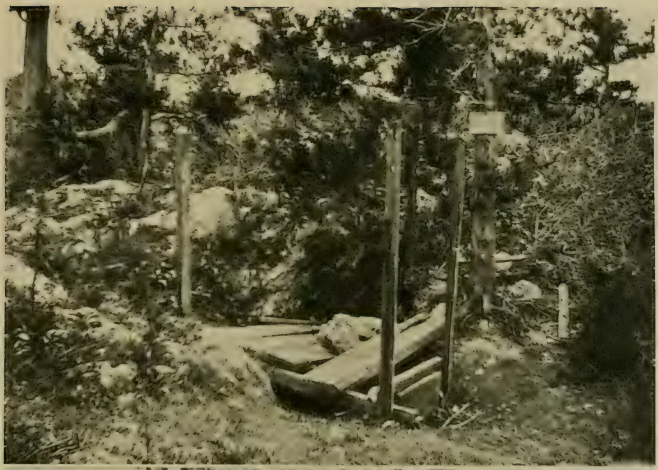
Birds of the latter group, according to Mr. Mowbray, are still breeding on certain of the Bermuda Islands—*Puffinus obscurus* among them; they lay their eggs at the end of February and early in March. Two of these localities are, I believe, known to Mr. Mowbray alone; he proposes to keep the secret, and allow these much-persecuted birds to breed in peace and safety.

Crystal Cave was discovered in a peculiar and interesting manner. It seems that the property, on which the entrance to it occurs, is owned by a negro named Gibbons. One of his sons and some other negro boys were playing ball one day on this land, when the ball rolled down a big hole that had not previously been noticed by them. Mr. Mowbray says: "This hole, no doubt, was opened up as an air hole, caused by the rise and fall of the tide in the cave, and was not the entrance by which the birds entered. That entrance must have been closed by subsidence." This Gibbons boy crawled into this newly discovered entrance after his ball, and when once inside he soon espied the calcite formations

within the cavern. A few days later he returned to the place; broke off several of the stalactites, and carried them to the Bermuda Museum with the hope of selling them. Mr. Mowbray at once recognized that the specimens were of an exceptionally fine type, so he planned a trip to this new cave for the purpose of exploring it more or less thoroughly. He says: "It turned out to be a cave of enormous proportions for a Bermuda cave. While looking around, I found the skull of a rat, the skull of a bat, and some bird-bones. On swimming across the lake to the other side of the cave, I discovered embedded in the calcite the leg-bones of a bird. On careful examination, I located a number of others, some three or more inches in the calcite floor. I decided to return and remove them: and in two or three days after the first visit, which was the second day of May, 1907, I removed the bones, and made some photographs of myself removing the bones and showing the interior of the cave."

Through Mr. Mowbray's kindness, I am enabled to reproduce two of his photographs—the ones he speaks of—as illustrations to this article (Pl. XX.). The upper one shows the entrance to the new cave described in the last few paragraphs, while the lower one gives a view of its interior, with Mr. Mowbray at work cutting out the bird-bones from the calcite floor. Doubtless there are a great many very interesting and important discoveries yet to be made in this beautiful cavern; and it will well repay some good, scientific explorer to thoroughly investigate it, with the view of obtaining some of this valuable material for scientific description and comparison. Mr. Mowbray and Mr. McGall have done their share; now let someone else try a hand.

It took several months of steady work on my part to write up these collections, and to describe and photograph all the bird-bones sent me for the purpose. As I have remarked above, all the bones examined by me were of birds, and they were either Shearwaters or Petrels. The famous "Cahow" proved to be a new Petrel instead of a well-known species of Shearwater; and the material



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MENPES PRESS, WATFORD.

CRYSTAL CAVE, BERMUDA.

1. The Entrance. 2. The Interior.

examined by me to prove this was so perfect and so abundant, that it left not a scintilla of doubt on the subject. There were also represented two new Shearwaters, both belonging to the genus *Puffinus*, of which there is quite a number in our fauna at the present time, but no one of them so small as one of the two I described as coming from the caves of the Bermudas. I am firmly convinced that there is a good deal of interesting osteological material in those caves, awaiting the search of the next intrepid explorer, who may be able to enter those which have been hitherto unexplored.

ADDENDUM.

As this brief article was about to go to press, several things happened which inclined me to add a page or two to it, in order that the whole might be more complete and up to date.

In the first place, I have received one or two very interesting and kind letters from Mr. Richard Higgins Burne, Curator of the Osteological Section of the Royal College of Surgeons of England, London; it affords me great pleasure to thank him here for these, and for the very important and useful sketches and photographs he made for me of skulls and skeletons in the collection of which he has charge. These were of various tubinarine birds, examples of which I could not obtain in this country, and which materially aided me in diagnosing the new species I had to describe in the above-named memoir.

Owing to the fact that the latter cannot now appear for an indefinite length of time, for reasons given me by the Director of the American Museum of Natural History, I have thought it no more than fair to that museum, to the collectors of the material, and to myself and other avian palæontologists, that I should incorporate a few paragraphs here, setting forth descriptions of the new species of birds, which I found represented in the collection by their skeletal

remains, publishing them in advance of the memoir as a whole. In doing this, it will not be necessary to publish any of the plates I have prepared to illustrate the bones of these new species, as they—there are many of them—will all appear in due course in the aforesaid memoir, which required many weeks of daily and continuous labour to complete.

The material for the new species, descriptions of which are given below, belongs chiefly to the collectors and to the American Museum of Natural History of New York City—possibly it may now all be in the hands of the latter institution. The borrowed material which I used for comparative purposes came from numerous sources, and it is fully acknowledged elsewhere.

Puffinus mcgalli, sp. nov.

Recent Epoch.

(Figured in the original memoir on pl. vii. fig. 29, and pl. viii. fig. 36.)

Based on an almost perfect *sternum* of an adult individual discovered in the bird-bone caves of Bermuda.

Upon comparing this sternum with the sterna of other Shearwaters, it at once becomes evident that it belonged to a species of *Puffinus* of moderate size, and probably possessed characters in its skeleton agreeing, in all respects, with those of that genus, as the osteological characters of all known typical members of this group of birds are in close agreement, the mere matter of *size* being all we have, in some instances, to distinguish them. This being true—the material before us for comparison being in sufficient quantity and the sexes and ages well represented—this matter of *size* must be given due weight in the matter of determining new species, whether these species be existing and new to science, or extinct and heretofore undescribed.

This sternum belonged to a bird that in life was considerably larger than the existing *Puffinus lherminieri*, as the length of this bone in the former measures, from the anterior tip of the manubrium to the extreme posterior point of the mid-xiphoidal process, 5·8 centimetres, while

in the latter this line or distance equals but 4·4 centimetres. From apex to apex of the coracoidal processes, *P. mcgalli* measures 3·3 centimetres, and *P. therminieri* but 2 5 centimetres.

Upon comparing this sternum with the sternum of *Puffinus major* (No. 18076, Coll. U.S. Nat. Mus.), the latter is seen to be a species very considerably larger than the one here being described. I have also compared it with the sterna of *Puffinus creatopus*, *P. borealis*, *P. griseus*, and others, but it departs more or less from all of them.

In the collection of the U.S. National Museum, there is a Shearwater (No. 19385) labelled "*Puffinus gavia*, San Diego, Cal." Sharpe, in his 'Hand-list' (vol. i. p. 124), restricts the range of this species to "New Zealand and Australia." It is not listed in the A.O.U. Check-List (1910). This "*P. gavia*" was a bird of almost exactly the same size as *Puffinus mcgalli*, and its sternum, measured as above, has a length of 5·6 cm., while its width, measured as above, equals 3·45 cm. It is not at all likely that the sternum here under consideration belonged to an individual of that species—that is, it did not belong to a *P. gavia*.

Sometimes the plumage and other external characters of species of the same genus of birds *of the same size* are strikingly different, while the skeletons of any two of those species may be *indistinguishable*. There is no reason to believe but that this may have been true of any two species of *Puffinus*—the two species compared being of the *same size*. For example, one would have to be very expert indeed in order to be able to distinguish the sternum of a specimen of *Dendroica coronata* from the same bone taken from a specimen of *Dendroica audubuni*—age and sex in the two individuals being the same. Had we skins of these two species, however, there would be no difficulty in identifying them, and pronouncing at once as to which was which. This is the case with respect to the bones of the skeleton of a great many birds of the existing avifauna; still, the expert osteologist, who may have been a constant student of the subject for a lifetime, and who has handled large

quantities of material, can, in nearly all cases, make correct diagnoses and references which would be impossible for one not having had such training and experience.

The extinct species of *Puffinus* here described is named after Mr. Edward McGall, in recognition of his success in obtaining this valuable collection of fossil bird-bones from Bermuda.

Puffinus parvus, sp. nov.

Recent Epoch.

(In the original memoir, the bones of this extinct species are figured on pl. ix. figs. 43–45; pl. x. figs. 55–56; pls. xi., xiii. figs. 101, 107, 121, 122, and 123.)

There is abundant evidence pointing to the fact of the existence of a small Shearwater, now extinct, that formerly was abundant in the Bermudan tubinarine assemblage of birds. This evidence rests upon the occurrence in the collections before me of many subfossil bones that belonged to various individuals representing it. For example, in that part of the collection belonging to the American Museum of Natural History, at the time I was at work upon the material, there were the following specimens, namely, a cranium (more or less imperfect), an ulna, a radius, a carpo-metacarpus, part of a sternum, four ossa innominata, a femur, a tibio-tarsus, and a metatarsus; while in the McGall collection I found five perfect humeri, three ulnæ, a radius, a carpo-metacarpus, a proximal joint of an index digit, a coracoid, an inferior mandible, an imperfect os furculum, a tarso-metatarsus, an os innominatum of the left side; subsequently, there also came to light an imperfect cranium. All of this material is described in great detail in my memoir, and I have compared it, character for character, with the bones of skeletons of all the Shearwaters and other forms that I could bring together from private and public collections in America and England.

These bones belonged to a Shearwater (*Puffinus*) smaller than Audubon's Shearwater (*Puffinus lherminieri*)—that is, smaller than any Shearwater in our present Atlantic Ocean

avifauna. Their characters all go to indicate that the bird was a typical *Puffinus*, one wherein the *sternum* was of the *short* variety, as in *Puffinus creatopus*; in other words, the body of the bone was not elongate, as it is in several of the *small* existing Shearwaters in various parts of the world.

Taken together, the bones representing this new and doubtless extinct species of *Puffinus* belonged to three or more different individuals—a conclusion I came to after carefully comparing and matching them.

We have no evidence based upon fossil or subfossil material, and no evidence based upon osteological material representing existing species of *Puffinus*, that there now exists or ever existed a typical Shearwater of this genus that was as small or smaller than it: hence I have bestowed upon it the specific name of *parvus*; and, as pointed out above, there is no doubt whatever but that the bird was a true *Puffinus*, as all the characters of the bones representing it indicate this, agreeing, as they do, with but slight specific variations, with those in the skeletons of its relatives now in existence.

Æstrelata vociferans, sp. nov.

(Extinct.)

Cahow, Bermudan Cahow or Noisy Petrel.

At the time I was at work upon my memoir, there was before me a large series of subfossil bones representing this extinct species and many individuals of both sexes. Naturally, then, a large part of my work was devoted to the discussion of this now extinct species. Upwards of one hundred figures on plates illustrate its osteology, while my reasons are given for retaining the name *Æstrelata* instead of the more correct one, in so far as spelling goes, of *Œstrelata* in use elsewhere.

The specific name *vociferans* explains itself; for this extinct species, long known as *the* "Cahow," was a very noisy bird in life, judging from all the accounts we have of it left us by the early writers.

It will be noted from what I say in my still unpublished memoir, so often referred to above, and which was long ago read at a regular meeting of the New York Zoological Society, that I was the first to demonstrate, through the assistance of abundant material, that the famous "Cahow" of literature was a Petrel (*Æstrelata*) and *not* a Shearwater (the "*Puffinus obscurus*" of ornithological and popular literature).

In order to establish this species here, it will be necessary to quote the following few paragraphs from my memoir, to wit: "It has long been a question among ornithologists as to whether the famous 'Cahow' was a Shearwater ('*Puffinus obscurus*'?) or a Petrel (*Æstrelata*). In so far as my observation carries me, there is at least one character in the skeleton by means of which we can, with certainty, distinguish from each other these two different kinds of birds. This character is seen in the form of the *cnemial process of the tibiotarsus*. In the genus *Puffinus*—and possibly in some of its near allies—the cnemial process of the tibiotarsus is conspicuously elongate, as we see it in the Grebes and Loons; while in the Petrels it is notably shorter, with rounded superior margin. These differences are well shown in the bones figured on pl. xii. (figs. 116–125 inclusive). Judging from this character, too, such forms as *Pelecanoides urinatrix* and *Procellaria cooki* are more closely related to the Petrels than to the Shearwaters of the genus *Puffinus* (see pl. iv. fig. 20, and pl. v. fig. 24). Judging from this character alone, there is no question but that the 'Cahow' of the Bermuda Islands was an *Æstrelata* and not a *Puffinus*. This fact is sustained by other osteological as well as external characters found in the representatives of the two genera in question. For example, both the horny sheaths to the mandible, as well as those parts in the dried skulls when deprived of the sheaths, are positively diagnostic with respect to these two groups of tubinarine birds. The differences in the external forms of the beaks are well shown in figs. 128–130 of pl. xvi. of my quoted

contribution, fig. 128 giving the beak of a typical Shearwater, and figs. 129 & 130 those of Petrels of the genus *Æstrelata*. I am of opinion that *Æ. vociferans* was closely related to *Æ. caribbæa* (fig. 129), as I have attempted to show upon a previous page of the memoir.

"The differences in the osseous mandibles of a Petrel (*Æstrelata vociferans*) and a Shearwater (*Puffinus lherminieri*) are easily appreciated upon comparing those parts in figs. 5 & 6 of pl. i. All Petrels and petrel-like birds possess osseous beaks or mandibles, such as we find figured in figs. 1–5, pl. i.; in fig. 11 of pl. iii., as well as in Cook's and the Diving Petrels.

"The *tarso-metatarsus* is generally long and slender in the Petrel-like forms; shorter and stouter in the Shearwaters. (See the various figures of this bone on my plates.)

"The 'Cahow,' then, was a Petrel of the genus *Æstrelata*; and with this point settled, I can proceed to give an account of its skeleton."

A full account of its osteology here follows in my memoir, which some day will doubtless be published.

EXPLANATION OF PLATE XX.

Upper figure: The entrance to Crystal Cave, Bermuda.
Lower figure: Mr. Mowbray at work in the interior of Crystal Cave.

XXXI.—*Eider Duck on the Ythan.*

By Brig.-General H. R. Kelh, M.Bam.O.U.

The river Ythan flows into the North Sea between Aberdeen and Peterhead. The coast there is very wild. Along the shores are sandhills, bordered inland by stretches of rough heather—a country very interesting to the naturalist, as it teems with bird-life.

In the spring months the chief feature of the Ythan Estuary is the enormous number of Eider Duck: hundreds of them, male and female, congregated on the sands or